method, it is possible to make the process simpler than when manufacturing the same kind of device using the multi epitaxial method.

Embodiment 8

[0170] FIG. **33** is sectional views showing, in order, manufacturing steps of a semiconductor device according to Embodiment 8. Firstly, manufacturing is carried out using the same procedure as in FIGS. **31** (*a*) to (*d*). In a subsequent step, however, firstly, a high concentration p-layer **55** is formed on the low concentration p-epitaxial layer **47** embedded inside the deep trench **46**, as shown in FIG. **33** (*a*), without the surface of the low concentration p-epitaxial layer **47** being etched back. Continuing, as shown in FIG. **33** (*b*), a planarization of the surface is carried out using chemical-mechanical polishing (CMP), or the like. In FIG. **33** (*c*), which is a subsequent step, a final device form is obtained in accordance with a step the same as the step forming the planar MOS structure of Embodiment 1. That is, as Embodiment 8 is a manufacturing method whereby the etching back of the low concentration p-epitaxial layer **47** shown in FIG. **32** (*a*) in Embodiment 7 is omitted, it is possible to simplify the steps more than in Embodiment 7.

[0171] In the structure of FIG. **33** (*c*), the low concentration p-epitaxial layer **47** and n-type low concentration region **42** have approximate charge balance, and the n-type surface region **43** and high concentration p-layer **55** have approximate charge balance. With a first main surface as a reference, the depth of the n-type surface region **43** and high concentration p-layer **55** is one-eighth or more, one-half or less, the depth of a whole parallel p-n layer portion.

[0172] As heretofore described, as it is possible according to Embodiment 8, to make a device wherein an Eoff-turn off dv/dt trade-off can be improved using the filling epitaxial method, it is possible to make the process simpler than when manufacturing the same kind of device using the multi epitaxial method.

Embodiment 9

[0173] In Embodiment 7 and Embodiment 8, the depths of the n-type surface region **43** and high concentration p-layers **48** and **55** are approximately equal but, in order to increase avalanche withstanding capability, it is sufficient that the high concentration p-layers **48** and **55** are formed so as to be deeper than the n-type surface region **43**.

[0174] FIG. **34** is sectional views showing, in order, manufacturing steps of a semiconductor device according to Embodiment 9. Firstly, manufacturing is carried out using the same procedure as in FIGS. **31**(*a*) to (*c*). In a subsequent step, firstly, the low concentration p-epitaxial layer **47** is epitaxially grown and embedded inside the deep trench **46**, as shown in FIG. **34**(*a*). It is preferable that the amount of the low concentration p-epitaxial layer **47** embedded is reduced in comparison with FIG. **31**(*d*). This is because it is possible to reduce the amount of etch back in a subsequent step. Although the surface of the low concentration p-epitaxial layer **47** is etched back using a plasma etching, or the like, in the following FIG. **34**(*b*), a deep etch back is carried out so that the height of the low concentration p-epitaxial layer **47** is lower than the lower end of the n-type surface region **43**. In the following FIG. **34**(*c*), the high concentration p-layer **48** is epitaxially grown and embedded inside the deep trench **46**, forming the high concentration p-layer **48** on the surface of the low concentration p-epitaxial layer **47**. Subsequently, as shown in FIG. **34**(*d*), a planarization of the surface is carried out using CMP, or the like. The structure of FIG. **34** (*e*) is obtained as a final device form.

[0175] As heretofore described, in Embodiment 9, the low concentration p-epitaxial layer **47** and n-type low concentration region **42** have approximate charge balance, and the n-type surface region **43** has approximate charge balance with the opposing high concentration p-layer **48**. However, as the lower end of the high concentration p-layer **48** is formed deeper than the lower end of the n-type surface region **43**, unlike in Embodiment **7**, a portion in which the high concentration p-layer **48** and n-type low concentration region **42** are opposed becomes p-rich. With a first main surface as a reference, the depths of the n-type surface region **43** and high concentration p-layer **48** are one-eighth or more, one-half or less, the depth of a whole parallel p-n layer portion, By so doing, it is possible to make a device, using the filling epitaxial method, wherein it is possible to achieve not only the same kind of Eoff-turn off dv/dt trade-off improvement as in Embodiment 7, but also, by providing a p-rich region, an improvement in avalanche withstanding capability. Herein, a region that is opposed to a certain region refers to a portion positioned at approximately the same depth as the certain region, and to which the certain region is adjacent (hereafter, the same applies in Embodiments 10 to 12).

Embodiment 10

[0176] Sectional views of manufacturing steps when applying the manufacturing steps of the semiconductor device according to Embodiment 9 to a manufacturing method for fabricating the semiconductor device according to Embodiment 2 are as in FIG. **35**. FIG. **35** is sectional views showing, in order, manufacturing steps of a semiconductor device according to Embodiment 10. Firstly, manufacturing is carried out using the same procedure as in FIGS. **31**(*a*) to (*c*). Next, in FIG. **35**(*a*), the low concentration p-epitaxial layer **47** is epitaxially grown and embedded inside the deep trench **46**, in the same way as in FIG. **34**(*a*). In the following step of FIG. **35**(*b*), the high concentration p-layer **55** is formed on the low concentration p-epitaxial layer **47**, without the low concentration p-epitaxial layer **47** being etched back. Subsequently, as shown in FIG. **35**(*c*), a planarization of the surface is carried out using CMP, or the like. A final device form is as in FIG. **35** (*d*).

[0177] As heretofore described, in Embodiment 10, unlike in Embodiment 9, the n-type surface region **43** on a first main surface side has approximate charge balance with the average concentration of the opposing low concentration p-epitaxial layer **47**, but other configurations are the same as in Embodiment 9. In Embodiment 10, the depths of the n-type surface region **43** and high concentration p-layer **55** are one-eighth or more, one-half or less, the depth of a whole parallel p-n layer portion having the first main surface as a reference.

Embodiment 11

[0178] In Embodiment 9, instead of deepening the high concentration p-layer **48**, a medium concentration p-layer **56** may be provided between a high concentration p-layer **57** and the low concentration p-epitaxial layer **47** so that the depths of the n-type surface region **43** and high concentration p-layer **57** are approximately the same. Embodiment 11 has this kind of structure.